NOVEMBER 1989 MONTHLY
GROUND WATER SAMPLING RESULTS
LIVINGSTON RAIL YARD
LIVINGSTON, MONTANA

ENVIROCON, INC.

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GROUND WATER SAMPLING RESULTS
LIVINGSTON RAIL YARD
LIVINGSTON, MONTANA

Submitted to:

Montana Department of Health
and Environmental Sciences
Cogswell Building
Helena, Montana 59620

Submitted by:

Envirocon, Inc.
101 International Way
P.O. Box 8243
Missoula, Montana 59807

Submittal Date:

February 13, 1990

ENVIROCON, INC.

DEPARTMENT OF
HEALTH AND ENVIRONMENTAL SCIENCES

STAN STEPHENS, GOVERNOR
COGSWELL BUILDING

STATE OF MONTANA

FAX # (406) 444-2606
HELENA, MONTANA 59620

Solid & Hazardous Waste Bureau
Telephone: (406) 444-2821

March 12, 1990

Harold Chambers
Montana State Library
Capitol Complex
Helena, MT 59620

Dear Mr. Chambers:

Enclosed is a copy of the November Groundwater Sampling Results (Envirocon, November 1989) for the BN/Livingston site. The appendices, which include the individual lab analyses, are not attached to this report. This information is summarized in Table 2.0 of the report. If you need a copy of the individual lab reports, please contact this office and we will send you one. Future quarterly reports will include this information.

The February 1990 report will include semi-volatiles, dissolved metals and PCB/pesticide analyses.

Please contact me if you have any questions.

Sincerely,

Janie Stiles for

John H. Wadhams
Project Coordinator

"AN EQUAL OPPORTUNITY EMPLOYER"

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1.0 INTRODUCTION

Burlington Northern Railroad, through its contractor Envirocon, Inc. (Envirocon), completed the third quarterly ground water sampling round at the Livingston rail yard during November 16 through 20, 1989. This sampling program and the protocols followed are outlined in the Interim Remedial Measures Work Plan (IRMWP) and subsequent amendments. A total of 43 ground water samples were taken from 33 wells. As shown on Table 1.0, this includes samples from 25 monitoring wells, five municipal water wells, and three private water wells. Figure 1.0 shows the locations of these wells. All of these wells are completed in the coarse-grained alluvial aquifer which underlies the Livingston rail yard and the city of Livingston. Prior to sampling, all wells were probed for water levels and the detection of any free petroleum products on the ground water surface.

All samples were analyzed for volatile organic compounds (VOCs) by EPA Method 524.2 and total petroleum hydrocarbons (TPH) by EPA Method 418.1. Thirty-nine samples were analyzed at Energy Laboratories, Inc. (ELI) in Billings, Montana, while three were analyzed at Inter-Mountain Laboratories (IML) in Bozeman, Montana. The Montana Department of Health and Environmental Sciences (MDHES) took split samples from three wells. These split samples were analyzed at the state laboratory in Helena, Montana. Laboratory results for all samples are compiled in Appendix A.

All interpretations presented in this report are necessarily based on information available at the time of publication. Interpretations may change when further data becomes available.

TABLE 1.0

CORRELATION OF WELL AND SAMLE NUMBERS
Nov-89

SAMPLE NUMBER	WELL NUMBER	ANALYTICAL METHOD*	SAMPLE METHOD	SAMPLE DATE
140101-151	TRIP BLANK	542.2 & 418.1	N/A	11/16/89
140101-152	L-87-1	524.2 & 418.1	DBP	11/16/89
140101-153	L-88-9	524.2 & 418.1	DBP	11/16/89
140101-154	#6	524.2 & 418.1	DBP	11/16/89
140101-155	#7	524.2 & 418.1	DBP	11/16/89
140101-156	L-88-11	524.2 &418.1	DBP	11/16/89
140101-157	L-88-10	524.2 & 418.1	DBP	11/16/89
140101-158	LS-8	524.2 & 418.1	DBP	11/16/89
140101-159	LS-11	524.2 & 418.1	DBP	11/16/89
140101-160	#8	524.2 & 418.1	DBP	11/16/89
140101-161	L-87-3	524.2 & 418.1	DBP	11/16/89
140101-162	L-88-12	524.2 & 418.1	DBP	11/16/89
140101-163	L-87-5	524.2 & 418.1	DBP	11/16/89
140101-165	POTW	524.2 & 418.1	TAP	11/16/89
140101-171	IML DUP OF # 6	524.2 & 418.1	DBP	11/16/89
140101-172	IML TRIP BLANK	524.2 & 418.1	N/A	11/16/89
140101-173	IML DUP OF #7	524.2 & 418.1	DBP	11/16/89
140101-174	IML DUP OF L-88-11	524.2 & 418.1	DBP	11/16/89
140101-175	DUPLICATE OF L-88-10	524.2 & 418.1	DBP	11/16/89
140101-176	TRIP BLANK	524.2 & 418.1	N/A	11/17/89
140101-177	#11	524.2 & 418.1	NDBP	11/17/89
140101-178	#5	524.2 & 418.1	NDBP	11/17/89
140101-179	LS-6	524.2 & 418.1	NDBP	11/17/89
140101-180	#1	524.2 & 418.1	NDBP	11/17/89
140101-181	#3	524.2 & 418.1	NDBP	11/17/89
140101-182	DUPLICATE OF #3	524.2 & 418.1	NDBP	11/17/89
140101-183	DECON BLANK	524.2 & 418.1	NDBP	11/17/89
140101-184	#2	524.2 & 418.1	NDBP	11/17/89
140101-185	L STREET	524.2 & 418.1	TAP	11/17/89
140101-186	Q STREET	524.2 & 418.1	TAP	11/17/89
140101-187	L-88-13	524.2 & 418.1	DBP	11/18/89
140101-188	L-87-8	524.2 & 418.1	DBP	11/18/89
140101-189	L-87-2	524.2 & 418.1	DBP	11/18/89
140101-190	L-87-7	524.2 & 418.1	DBP	11/18/89
140101-191	L-87-4	524.2 & 418.1	DBP	11/18/89
140101-192	LS-7	524.2 & 418.1	DBP	11/18/89
140101-193	DUPLICATE OF L-87-8	524.2 & 418.1	DBP	11/18/89
140101-194	RAINBOW MOTEL	524.2 & 418.1	TAP	11/18/89
140101-195	DEPUY	524.2 & 418.1	TAP	11/18/89
140101-198	WERNER STREET	524.2 & 418.1	TAP	11/17/89
140101-199	CLARENCE STREET	524.2 & 418.1	TAP	11/17/89
140101-200	BURNS	524.2 & 418.1	TAP	11/17/89
140101-201	B STREET	524.2 & 418.1	TAP	11/20/89
140101-205	B STREET	524.2 & 418.1	TAP	12/7/89

NOTES: * Refers to EPA analytical method
DBP - Dedicated bladder pump
NDBP - Non-dedicated bladder pump
N/A - Not applicable

2.0 SUMMARY

Ground water in the alluvial aquifer underlying the Livingston rail yard contains a plume of dissolved VOCs, a plume of diesel fuel on and above the water table, and localized concentrations of dissolved petroleum hydrocarbons. The VOC and diesel plumes emanate from separate areas on the rail yard, but their boundaries overlap.

VOCs are present in a plume extending northeast from the shop complex as shown on Figure 2.0. There appears to be three primary source areas contributing to this VOC plume. These are the shop complex area, waste water treatment plant (WWTP) area, and the API separator and overflow pond. The highest VOC concentrations recorded were from a single sample from monitoring Well L-87-2, 200 feet downgradient (northeast) from the WWTP sump. This was the first sample taken by Envirocon from monitoring Well L-87-2. Further sampling is needed to validate the results from this well.

A plume of diesel fuel is present on the ground water surface beneath the rail lines adjacent to the main shop complex and Park Street. The plume has a surface area of approximately 40 acres. Free product thicknesses in the diesel plume range from a sheen up to 1.75 feet.

Detectable concentrations of TPH dissolved in the ground water are mostly beneath the diesel plume. Concentrations range up to 10.6 parts per million (ppm).

3.0 RESULTS AND DISCUSSION

This section presents results and interpretation of samples from the monitoring well network, city municipal water wells, and private wells sampled during the November 1989 quarterly sampling round.

3.1 Potentiometric Data and Ground Water Flow Directions

Water table elevations were measured at 45 points throughout the northeast half of the city of Livingston. All measurements were taken between November 16 and 21, 1989. Water table elevations and potentiometric contours, as interpreted from this data, are shown on Figure 1.0.

Water table elevations revealed that ground water flowed northeast beneath the rail yard, nearly parallel with Park Street, during November 1989. This flow pattern is similar to the flow directions recorded during the summer and fall of 1989.

Within approximately 1,500 feet of the Yellowstone River, ground water flow directions vary seasonally to a greater degree than in other parts of the aquifer. Ground water flow beneath the east end of the rail yard shifted to a more northeastward direction in November 1989. This appears to be part of a seasonal shift in ground water flow near the Yellowstone River. During summer and early fall, flow is eastward into the river; however, it changes to a northward flow along the river during winter and early spring.

3.2 Water Quality

Discussion of ground water sample results is separated into a discussion of VOC results and a discussion of the diesel plume and TPH results. These two groups of contaminants are derived from different source areas and have different transport characteristics within the aquifer.

3.2.1 VOCs

VOCs are present in three identifiable zones within a plume in the alluvial aquifer. The most common VOCs detected in these zones are the chlorinated ethenes tetrachloroethene (PCE), trichloroethene (TCE), dichloroethene (DCE), and the chlorinated aromatics chlorobenzene and chlorotoluene. Isolated occurrences of other VOCs are limited to Wells L-87-2 and L-87-7. Complete results from all wells are included in Appendix A.

The VOC plume extends east from the shop complex area. The plume contains three separate zones.

While the boundaries of the zones overlap, each zone exhibits different ratios of chlorinated compounds and emanates from separate sources on the rail yard. These source areas are the main shop complex area, the waste water treatment plant area, and the API separator and overflow pond. Figure 2.0 shows the interpreted boundary and extent of total chlorinated ethenes in the alluvial aquifer. This map is a composite of all three identifiable zones within the plume.

3.2.1.1 Shop Complex Area

The shop complex area appears to have been a source of PCE to the alluvial aquifer. PCE is the predominant VOC detected at Wells L-87-5 and L-88-12, immediately downgradient from the shop complex. Concentrations of TCE and DCE are much smaller in comparison, and no other volatile constituents have been detected from samples within these wells. As shown on Table 2.0, chlorinated ethene concentrations at Well L-87-5 have been extremely stable since May 1989.

The exact location of the source within the shop complex area and the release mechanism of VOCs at this source are not understood at this time. Drilling monitoring Wells 89-3, 89-8, and 89-9 through the shop floors will help characterize soil conditions beneath the shop buildings.

3.2.1.2 WWTP Area

The WWTP area appears to be a source of DCE, chlorobenzene, and chlorotoluene to the alluvial aquifer. The most apparent source of these compounds is the WWTP sump; however, other possible sources exist in the WWTP area. As shown on Table 2.0, a November 1989 sample taken from Well L-87-2, 200 feet east of the WWTP sump, contained 2,571 parts per billion (ppb) of DCE, 159 ppb chlorobenzene, 78 ppb chlorotoluene, and 1.4 ppb vinyl chloride. This was a single sample and further sampling is necessary to validate these results.

If the results from monitoring Well L-87-2 are validated by future samples, this area will contain the largest concentration of chlorinated compounds recorded from a monitoring well on the rail yard by Envirocon. It will also be the first detection of vinyl chloride in any soil or ground water sample. The presence of increased DCE concentrations and vinyl

TABLE 2.0
COMPARISON OF 1989 MONTHLY ANALYTICAL RESULTS
LIVINGSTON RAIL YARD, LIVINGSTON, MONTANA

WELL	PCE (ug/l)						
NO.	MAY	JUNE	JULY	AUG	SEP	OCT	**NOV**
1			0.66	0.62			**0.65**
2			0.7	1.3			**0.55**
3	0.69			0.74			**0.50**
4				<0.5			
5	<0.5			<0.5			**<0.5**
6	7.1	11	7.2	4.9	3.9	4.2	**3.6**
7	33	7.9	0.77	0.5	<0.5	<0.5	**0.5**
8	180	188	151	126	112	96	**123**
11			<0.5	<0.5			**<0.5**
L-87-1	<0.5			<0.5			**<0.5**
L-87-2							**1.7**
L-87-3	262	183	188	195	206	197	**200**
L-87-4	<0.5	<0.5		<0.5			**<0.5**
L-87-5	335	350	349	367	361	355	**358**
L-87-7			<0.5	<0.5	0.87	<0.5	**<0.5**
L-87-8	58	32	68	98	104	118	**86**
L-88-9	<1.0			<0.5			**<0.5**
L-88-10	160		137	155	147	148	**165**
L-88-11	<0.5			<0.5			**<0.5**
L-88-12	255			197			**250**
L-88-13	52	62	69	80	80	86	**66**
LS-6	<0.5			<0.5			**<0.5**
LS-7	<0.5			<0.5			**<0.5**
LS-8	146	181	136	98	86	96	**61**
LS-11	115	164		23	17	11	**12**
RAINBOW	35						**64**
DEPUY							**7.2**
BURNS							**<0.5**
POTW	73			46			**23**
B-STR.				**	<0.5	<0.5	**<0.5**
D-STR.				<0.5			
L-STR.	<0.5			<0.5			**<0.5**
Q-STR.	0.66			0.95			**0.71**
CLARENCE				<0.5			**<0.5**
WERNER				<0.5			**<0.5**

WELL	TCE (ug/l)						
NO.	MAY	JUNE	JULY	AUG	SEP	OCT	**NOV**
1			<0.5	<0.5			**<0.5**
2			<0.5	<0.5			**<0.5**
3	<0.5			<0.5			**<0.5**
4				<0.5			
5	<0.5			<0.5			**<0.5**
6	<0.5	0.5	<0.5	<0.5	<0.5	<0.5	**<0.5**
7	1.2	<0.5	<0.5	<0.5	<0.5	<0.5	**<0.5**
8	9.9	10	8.5	10	5.5	5.1	**5.9**
11			<0.5	<0.5			**<0.5**
L-87-1	<0.5			<0.5			**<0.5**
L-87-2							**24**
L-87-3	24	22	18	17	15	15	**17**
L-87-4	<0.5	<0.5		<0.5			**<0.5**
L-87-5	8.7	11	15	15	12	13	**10**
L-87-7			<0.5	<0.5	<0.5	<0.5	**<0.5**
L-87-8	7.8	4.3	7.3	11	13	10	**8.8**
L-88-9	<0.5			<0.5			**<0.5**
L-88-10	31		28	30	30	32	**26**
L-88-11	<0.5			<0.5			**<0.5**
L-88-12	4.9			4.5			**4.1**
L-88-13	7.6	8.1	11	14	14	14	**12**
LS-6	<0.5			<0.5			**<0.5**
LS-7	<0.5			<0.5			**<0.5**
LS-8	20	16	14	7.8	6.1	5.7	**6.6**
LS-11	17	15		30	24	19	**23**
RAINBOW	5.2						**12**
DEPUY							**1.3**
BURNS							**<0.5**
POTW	6.9			2.1			**0.69**
B-STR.				**	<0.5	<0.5	**<0.5**
D-STR.				<0.5			
L-STR.	<0.5			<0.5			**<0.5**
Q-STR.	<0.5			<0.5			**<0.5**
CLARENCE				<0.5			**<0.5**
WERNER				<0.5			**<0.5**

WELL	DCE* (ug/l)						
NO.	MAY	JUNE	JULY	AUG	SEP	OCT	**NOV**
1			<1.0	<1.0			**<1.0**
2			<1.0	<1.0			**<1.0**
3	<1.0	<1.0		<1.0			**<1.0**
4				<1.0			
5	<1.0			<1.0			**<1.0**
6	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	**<1.0**
7	2.9	1.3	<1.0	<1.0	<1.0	<1.0	**<1.0**
8	17	24	35	27	19	13	**12**
11			<1.0	<1.0			**<1.0**
L-87-1	<1.0			<1.0			**<1.0**
L-87-2							**2571**
L-87-3	68	121	81	56	46	42	**37**
L-87-4	<1.0	<1.0		<1.0			**<1.0**
L-87-5	5.4	6.2	7.5	7.8	7	6.8	**6.3**
L-87-7			<1.0	<1.0	<1.0	<1.0	**<1.0**
L-87-8	3.5	2.4	6.1	9.3	5.1	8	**7.2**
L-88-9	<1.0			<1.0			**<1.0**
L-88-10	106		197	357	410	463	**440.5**
L-88-11	<1.0			<1.0			**<1.0**
L-88-12	3.5			2.1			**2.3**
L-88-13	6.8	8.1	17	24	27	21	**19**
LS-6	<1.0			<1.0			**<1.0**
LS-7	<1.0			<1.0			**<1.0**
LS-8	84.3	69	45	21	17	13	**13**
LS-11	58	60		122	140	110	**89**
RAINBOW	8.9						**64**
DEPUY							**<1.0**
BURNS							**<1.0**
POTW	9.2			5.5			**<1.0**
B-STR.				**	<1.0	<1.0	**<1.0**
D-STR.				<1.0			
L-STR.	<1.0			<1.0			**<1.0**
Q-STR.	<1.0			<1.0			**<1.0**
CLARENCE				<1.0			**<1.0**
WERNER				<1.0			**<1.0**

WELL	2-CHLOROTOLUENE (ug/l)						
NO.	MAY	JUNE	JULY	AUG	SEP	OCT	**NOV**
1			<1.0	<1.0			**<1.0**
2			<1.0	<1.0			**<1.0**
3	<1.0			<1.0			**<1.0**
4				<1.0			
5	<1.0			<1.0			**<1.0**
6	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	**<1.0**
7	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	**<1.0**
8	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	**<1.0**
11			<1.0	<1.0			**<1.0**
L-87-1	<1.0			<1.0			**<1.0**
L-87-2							**78**
L-87-3	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	**<1.0**
L-87-4	<1.0	<1.0		<1.0			**<1.0**
L-87-5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	**<1.0**
L-87-7			1.1	1.1	1	1	**<1.0**
L-87-8	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	**<1.0**
L-88-9	<1.0			<1.0			**<1.0**
L-88-10	<1.0		1	3.6	5.7	5	**3.5**
L-88-11	<1.0			<1.0			**<1.0**
L-88-12	<1.0			<1.0			**<1.0**
L-88-13	<1.0	<1.0	<1.0	<1.0	1	<1.0	**<1.0**
LS-6	<1.0			<1.0			**<1.0**
LS-7	<1.0			<1.0			**<1.0**
LS-8	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	**<1.0**
LS-11	<1.0	<1.0		<1.0	<1.0	<1.0	**<1.0**
RAINBOW	<1.0						**<1.0**
DEPUY							**<1.0**
BURNS							**<1.0**
POTW	<1.0			<1.0			**<1.0**
B-STR.				**	<1.0	<1.0	**<1.0**
D-STR.				<1.0			
L-STR.	<1.0			<1.0			**<1.0**
Q-STR.	<1.0			<1.0			**<1.0**
CLARENCE				<1.0			**<1.0**
WERNER				<1.0			**<1.0**

WELL	CHLOROBENZENE (ug/l)						
NO.	MAY	JUNE	JULY	AUG	SEP	OCT	**NOV**
1			<1.0	<1.0			**<1.0**
2			<1.0	<1.0			**<1.0**
3	<1.0			<1.0			**<1.0**
4				<1.0			
5	<1.0			<1.0			**<1.0**
6	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	**<1.0**
7	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	**<1.0**
8	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	**<1.0**
11			<1.0	<1.0			**<1.0**
L-87-1	<1.0			<1.0			**<1.0**
L-87-2							**159**
L-87-3	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	**<1.0**
L-87-4	<1.0	<1.0		<1.0			**<1.0**
L-87-5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	**<1.0**
L-87-7			<1.0	<1.0	<1.0	<1.0	**<1.0**
L-87-8	<1.0	<1.0	<1.0	<1.0	1	<1.0	**<1.0**
L-88-9	<1.0			<1.0			**<1.0**
L-88-10	8.7		10	28	36	39	**43**
L-88-11	<1.0			<1.0			**<1.0**
L-88-12	<1.0			<1.0			**<1.0**
L-88-13	<1.0	<1.0	2.2	3.6	3.2	2.9	**1.9**
LS-6	<1.0			<1.0			**<1.0**
LS-7	<1.0			<1.0			**<1.0**
LS-8	27	<1.0	<1.0	<1.0	<1.0	<1.0	**<1.0**
LS-11	<1.0	<1.0		167	275	319	**305**
RAINBOW	<1.0						**3.5**
DEPUY							**<1.0**
BURNS							**<1.0**
POTW	<1.0			<1.0			**<1.0**
B-STR.				**	<1.0	<1.0	**<1.0**
D-STR.				<1.0			
L-STR.	<1.0			<1.0			**<1.0**
Q-STR.	<1.0			<1.0			**<1.0**
CLARENCE				<1.0			**<1.0**
WERNER				<1.0			**<1.0**

*Notes: * Includes both cis-1,2 and trans-1,2 DCE*

*** Not sampled due to construction near well*

chloride at this well may indicate dehalogenation of chlorinated ethenes, such as PCE, contained within the WWTP sump.

As proposed in the Sludge Isolation Work Plan, containment of the WWTP sump sludges and other source control measures beneath the sump should help reduce the effect of this source of contamination.

3.2.1.3 API Separator and Overflow Pond

The API separator and overflow pond area also appear to be a source of chlorinated compounds to the alluvial aquifer. Test excavations through the base of the API separator and overflow pond during December 1989 revealed oily leachate penetration to the water table. Three soil samples (140101-SO-001, 140101-SO-002, and 140101-SO-003) taken from the gravels beneath the sludges contained up to 15,800 mg/kg TPH and concentrations of several volatile and semivolatile organic compounds in the parts per million range. PCE, TCE, and DCE were not detected in these soil samples; however, the detection limits for soil samples were 200 ppb. Complete results of these soil samples are included in Appendix B. A full report on Envirocon soil and sludge sampling is forthcoming.

Samples from monitoring Wells LS-8 and LS-11, immediately downgradient from the API separator and overflow pond, have shown fluctuating monthly concentrations in chlorinated compounds since May 1989. Both DCE and chlorobenzene concentrations at Well LS-11 increased during the summer and early fall and then began to decline, as shown on Table 2.0. Over this same period, PCE concentrations at this well decreased. In contrast to Well LS-11, concentrations of all chlorinated compounds have decreased at Well LS-8 since May 1989. It is possible that separate sources affect chlorinated compound concentrations independently at these closely-spaced wells.

3.2.1.4 Cinder Pile Lagoon

It is uncertain whether the cinder pile lagoon is a chlorinated ethene source to the alluvial aquifer. No clear increase in chlorinated ethene concentrations is apparent downgradient from the cinder pile lagoon at monitoring Wells L-87-3 and L-87-8.

Test excavations beneath the cinder pile lagoon during sludge isolation work on December 28, 1989 revealed cinders and a clay layer beneath the lagoon. The potential mobility of VOCs in these soils is unknown at this time. Soil Sample 140101-SO-007 was taken from the soils beneath the cinder pile lagoon. Results of this sample are not available at this time.

3.2.1.5 Well L-87-7

Sample results from Well L-87-7 indicate the presence of a group of typical gasoline constituents, as shown on Table 3.0. These compounds were not detected in ground water samples from any of the other monitoring wells during November 1989.

3.2.2 Diesel Plume and TPH Concentrations

The diesel plume occupies approximately the same position as it has throughout the summer and fall of 1989. Free product thicknesses at specific wells have varied slightly as the water table rose and fell; however, the overall shape and boundaries of the plume have remained similar. The shape and boundaries of the diesel plume during November 1989 are shown on Figure 3.0.

Total petroleum hydrocarbon concentrations for wells outside the diesel plume were all below 1 ppm, as shown on Table 3.0. Ground water

TABLE 3.0

SUMMARIZED RESULTS FROM MONITORING WELL L-87-7 (140101-190)

Nov-89

CONSTITUENT	CONCENTRATION (ug/l)
Ethylbenzene	2.9
Isopropylbenzene	3.6
n-Propylbenzene	1.1
sec-Butylbenzene	3.2
Naphthalene	9.1
Benzene	0.75

samples from below the diesel plume indicated TPH concentrations which ranged up to 10.6 ppm at Well L-87-2; however, the pump at Well L-87-2 was installed one month prior to sampling and may have contained a small amount of diesel contamination from the installation through the plume. This could also have affected the concentrations of chlorinated ethenes detected at this well in the November sample because this part of the diesel plume contains chlorinated ethenes.

3.3 Results from the Livingston Municipal Water Wells

Samples from the B Street, L Street, Q Street, Clarence Street, and Werner Wells were analyzed for VOCs by EPA Method 524.2 and TPH by EPA Method 418.1. The D Street Well was not operating during November 1989 and could not be sampled.

As shown on Table 2.0, no detectable concentrations of the VOCs analyzed by Method 524.2 were present in samples from the B Street, L Street, Clarence Street, and Werner Wells. The sample from the Q Street Well, which is not presently in use, contained 0.71 ppb (ug/l) of PCE. This is consistent with previous quarterly sample results from the Q Street Well.

As shown on Table 4.0, no detectable concentrations of TPH were found in samples from the L Street, Q Street, Clarence Street, and Werner Wells. This is consistent with previous sample results from these wells.

A sample from the B Street Well taken on November 20, 1989 revealed a concentration of 0.1 ppm (mg/l) of TPH. This concentration is the detection limit for TPH by EPA Method 418.1, so the detection is questionable. A second sample from the B Street Well was taken on December 7, 1989 to validate the November TPH detection. Analysis of the second sample did not show any detectable concentrations of VOCs by EPA

TABLE 4.0

TOTAL PETROLEUM HYDROCARBONS - 1989

CONCENTRATIONS (PPM)

WELL NO.	TPH (mg/l)		
	MAY	AUG	NOV
1		<0.1	<0.1
2		<0.1	<0.1
3	0.7	<0.1	<0.1
4		<0.1	
5	2.1		<0.1
6	0.7	<0.1	<0.1
7	0.6	0.3	<0.1
8	3	<0.1	<0.1
11		<0.1	0.2
L-87-1	0.8		<0.1
L-87-2			10.6
L-87-3	0.4	<0.1	<0.1
L-87-4	4.4	0.3	0.9
L-87-5	0.6	<0.1	<0.5
L-87-7		4.2	2
L-87-8	14.8	0.3	2
L-88-9	0.7	0.1	<0.1
L-88-10	0.6	0.1	<0.1
L-88-11	0.9	0.2	<0.1
L-88-12	0.7	<0.1	<0.1
L-88-13	2	<0.1	0.3
LS-6	9.9	0.2	<0.1
LS-7	4.2	0.9	<0.1
LS-8	0.8	0.1	<0.1
LS-11	0.5	1.7	0.4
DEPUY			<0.1
BURNS			<0.1
RAINBOW			<0.1
POTW			<0.1
B-STR.		**	0.1
D-STR.		<0.1	
L-STR.		<0.1	<0.1
Q-STR.		<0.1	<0.1
CLARENCE		<0.1	<0.1
WERNER		<0.1	<0.1

Method 524.2, TPH by EPA Method 418.1, total purgeable hydrocarbons by GC, or solvent extractable hydrocarbons by GC. The source of the 0.1 ppm TPH detection in the November 1989 sample is unknown and may have been incorrect considering that this value corresponds with the detection limit. Envirocon will resample the B Street Well again on December 21, 1989 during the December monthly sampling round.

4.0 QA/QC RESULTS

Envirocon followed the QA/QC program outlined in Section 10.0 of the Interim Remedial Measures Work Plan (IRMWP) during the November 1989 quarterly sampling round. This program includes:

- Field QA/QC
  - Field duplicates
  - MDHES splits
  - Trip blanks
  - Equipment blanks

- Laboratory QA/QC
  - Spiked analyses
  - Laboratory duplicates
  - EPA QA/QC samples

QA/QC samples were shipped "blind" to the laboratory and analyzed by the same analytical method (EPA Method 524.2) as the field samples.

4.1 Field QA/QC

Three field duplicates, one equipment blank, three trip blanks, and three MDHES splits were used to validate field procedures. Three samples

from the same wells split by MDHES were sent to IML in Bozeman, Montana.

4.1.1 Field Duplicates

Field duplicates from Wells L-88-10 (140101-175), 3 (140101-182), and L-87-8 (140101-193) were sent blind to ELI in Billings, Montana. As shown in Appendix A, analysis of the duplicates shows close correlation with the original samples from these wells. This indicates that field sampling, handling procedures, and laboratory procedures are sufficient to generate reproducible results.

4.1.2 MDHES Splits

MDHES split samples with Envirocon at Monitor Wells 6 (140101-154), 7 (140101-155), and L-88-11 (140101-156). Samples from these wells were also sent to IML as Samples 140101-171, 140101-173, and 140101-174. As shown on Table 5.0, a comparison of ELI and MDHES results shows extremely good correlation. This indicates that sampling procedures and ELI/MDHES analytical procedures are capable of providing comparable results.

4.1.3 Trip Blanks

As shown in Appendix A, no Method 524.2 analytes were detected in any of the three trip blanks used during the November 1989 quarterly sampling round. This indicates that sample handling and shipping protocols were sufficient to maintain sample integrity.

TABLE 5.0

COMPARISON OF PCE CONCENTRATIONS BETWEEN ELI, MDHES, IML

Nov-89

WELL #	ELI	MDHES	IML
7	0.5	0.5	<1.0
6	3.6	3.7	2
L-88-11	ND	ND	ND

* NOTES: ELI - ENERGY LABORATORIES, INC.
MDHES - MONTANA DEPT. OF HEALTH AND ENVIRONMENTAL SCIENCES
IML - INTER-MOUNTAIN LABORATORIES

4.1.4 Equipment Blank

One equipment blank (140101-183) was taken through Envirocon's stainless steel bladder pump. No Method 524.2 analytes, except chloroform, were detected in the sample. This indicates that decontamination procedures are sufficient to avoid cross contamination. Envirocon interprets the chloroform to be a result of residual chloroform in the deionized water used during equipment decontamination.

4.2 Laboratory QA/QC

Energy Laboratories conducted two spiked analyses, three laboratory duplicate analyses, and analyzed three sets of EPA QA/QC samples to validate laboratory procedures. ELI's QA/QC plan is on file with MDHES.

4.2.1 Spiked Analysis

Spiked analyses were conducted on Samples 140101-183 (equipment blank) and 140101-157 (Well L-88-10). Results of these analyses are shown in Appendix A. The percent recoveries of the test values are all within acceptable ranges. These results indicate that ELI's laboratory equipment and procedures were acceptable to provide satisfactory results.

4.2.2 Laboratory Duplicate Analysis

Energy Laboratories performed a duplicate analysis on Sample 140101-156 from Well LS-11. As shown in Appendix A, the concentrations of VOCs reported in the duplicate analysis are very close to those reported in the original sample analysis. This indicates that laboratory equipment and procedures were adequate to provide reproducible analytical results.

4.2.3 EPA QA/QC Samples' Analysis

Energy Laboratories analyzed one set of EPA QA/QC reference samples in addition to samples submitted by Envirocon. All test values were within acceptable ranges for percent recoveries. These results indicate that laboratory equipment and procedures were adequate to provide accurate results.

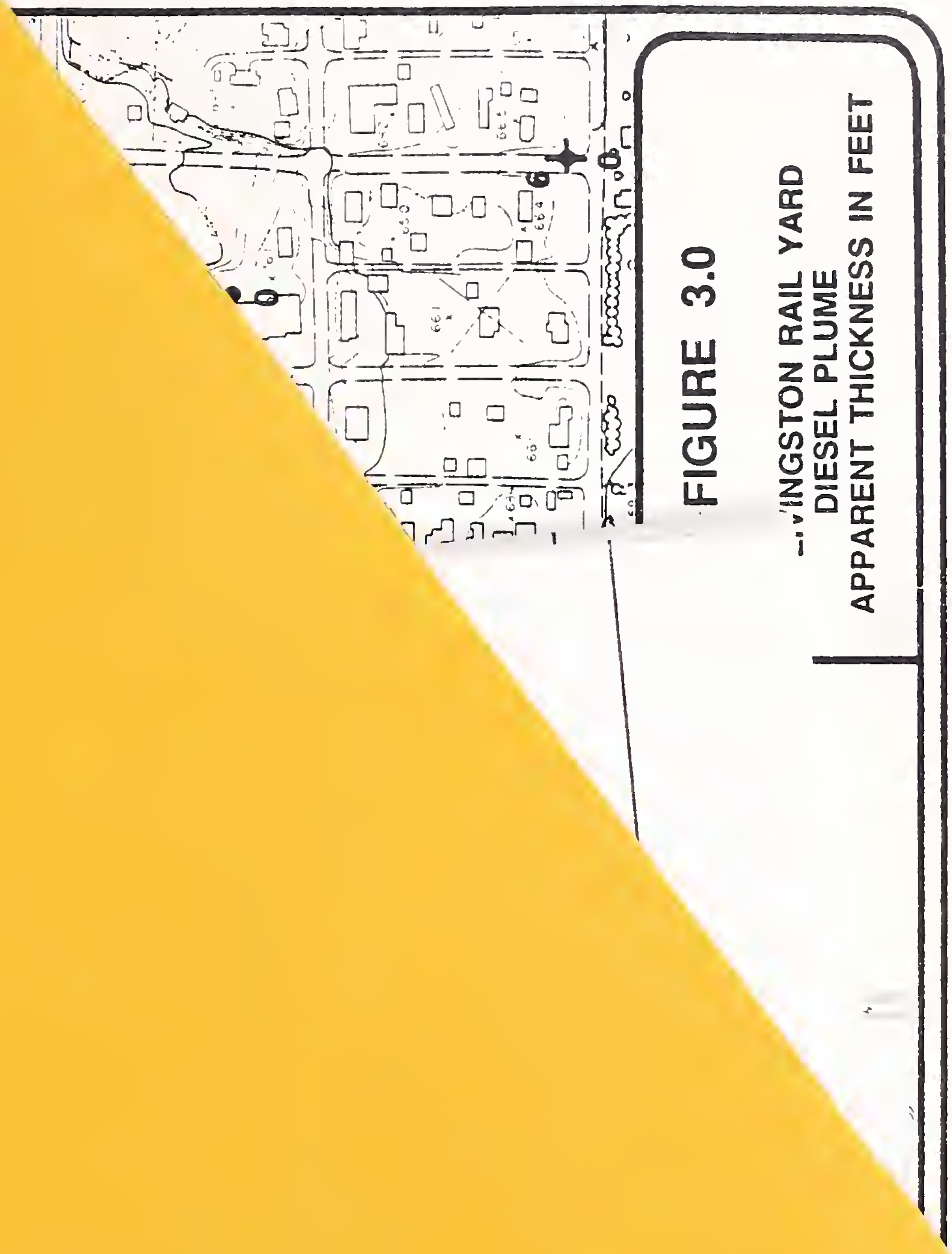
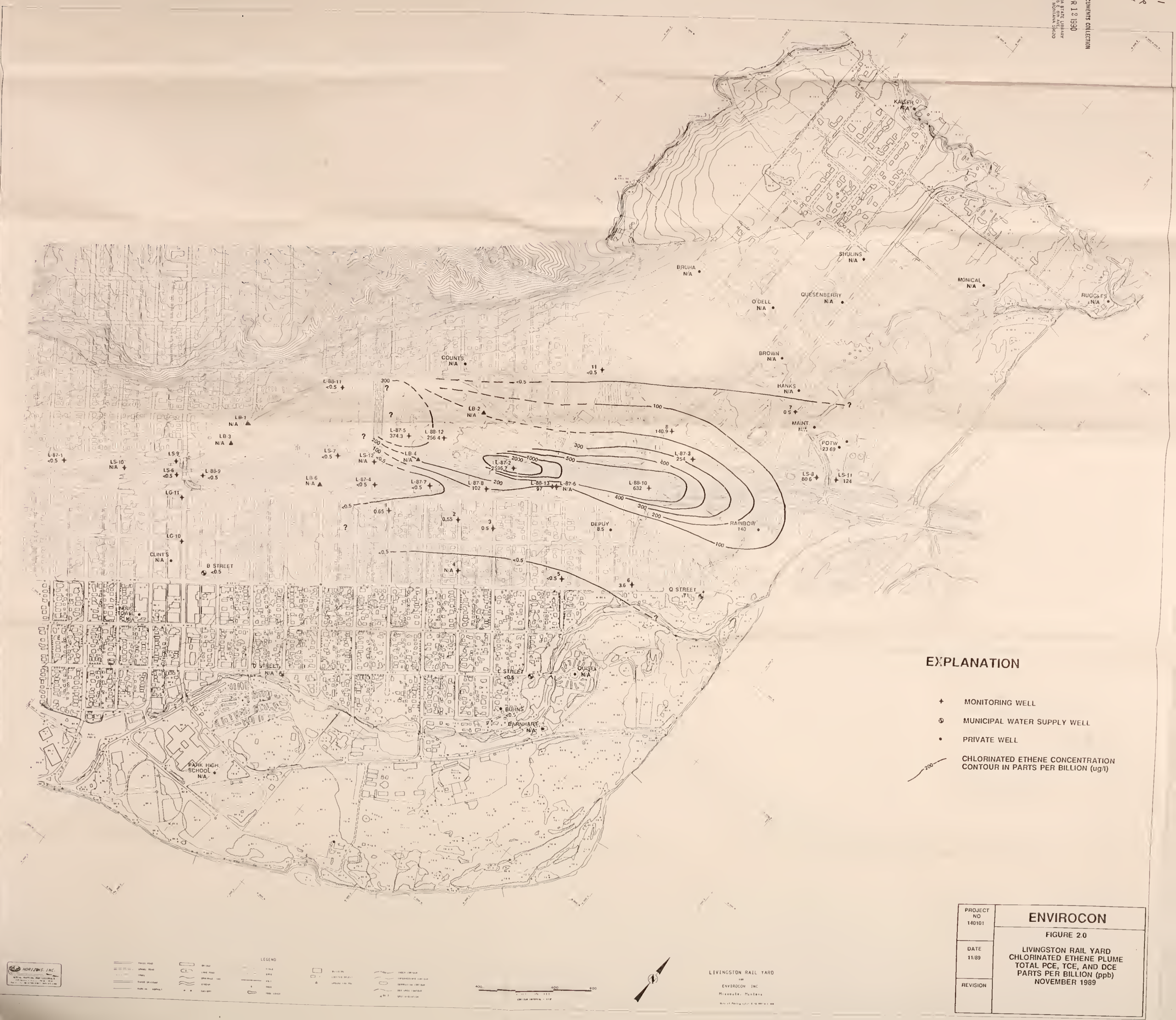


FIGURE 3.0

VINGSTON RAIL YARD
DIESEL PLUME
APPARENT THICKNESS IN FEET

FIGURE 1.0



EXPLANATION

✦	MONITORING WELL
⊕	MUNICIPAL WATER SUPPLY WELL
•	PRIVATE WELL
—200—	CHLORINATED ETHENE CONCENTRATION CONTOUR IN PARTS PER BILLION (ug/l)

PROJECT NO 140101	**ENVIROCON**
DATE 11/89	FIGURE 2.0 LIVINGSTON RAIL YARD CHLORINATED ETHENE PLUME TOTAL PCE, TCE, AND DCE PARTS PER BILLION (ppb) NOVEMBER 1989
REVISION	

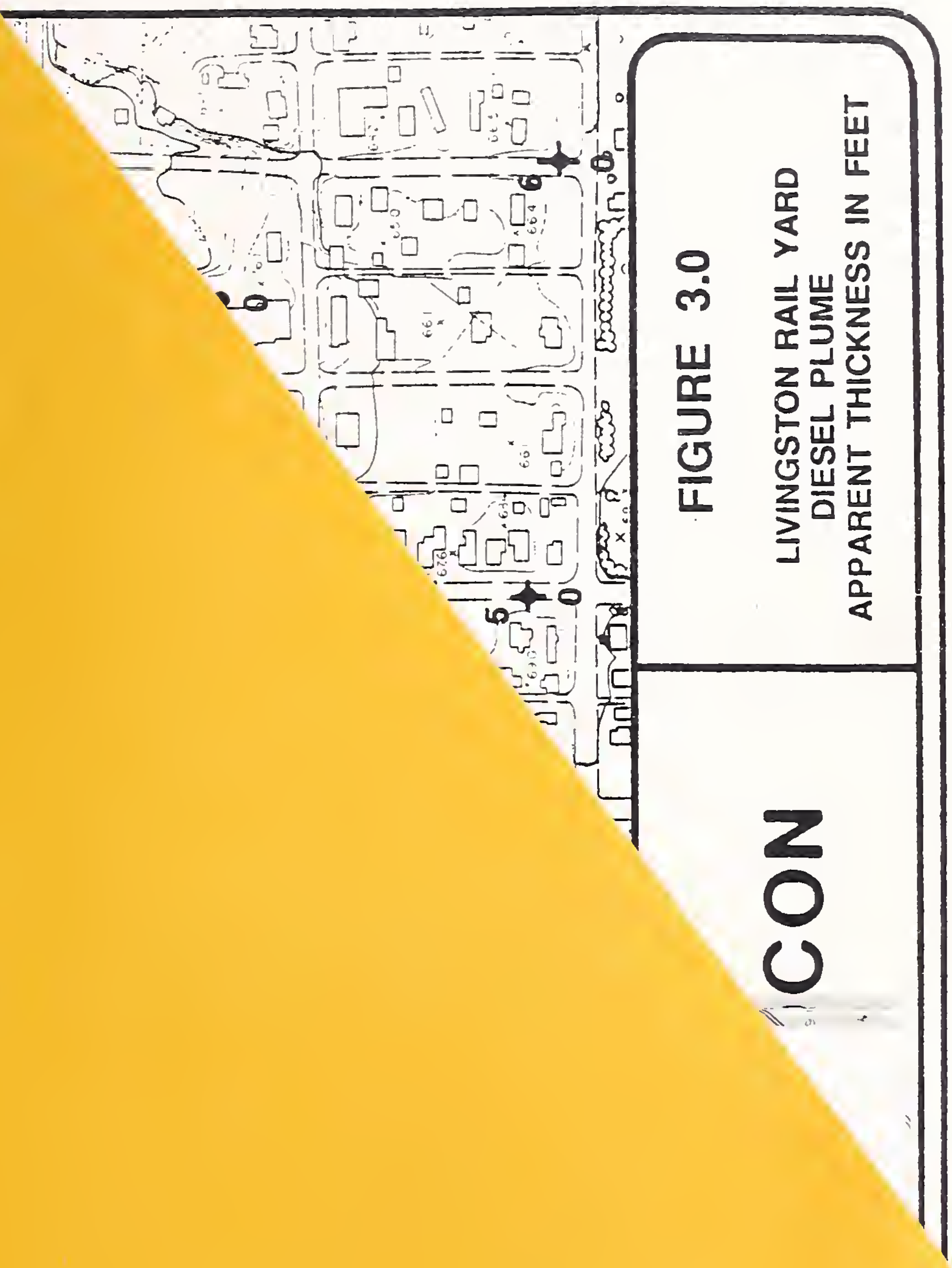
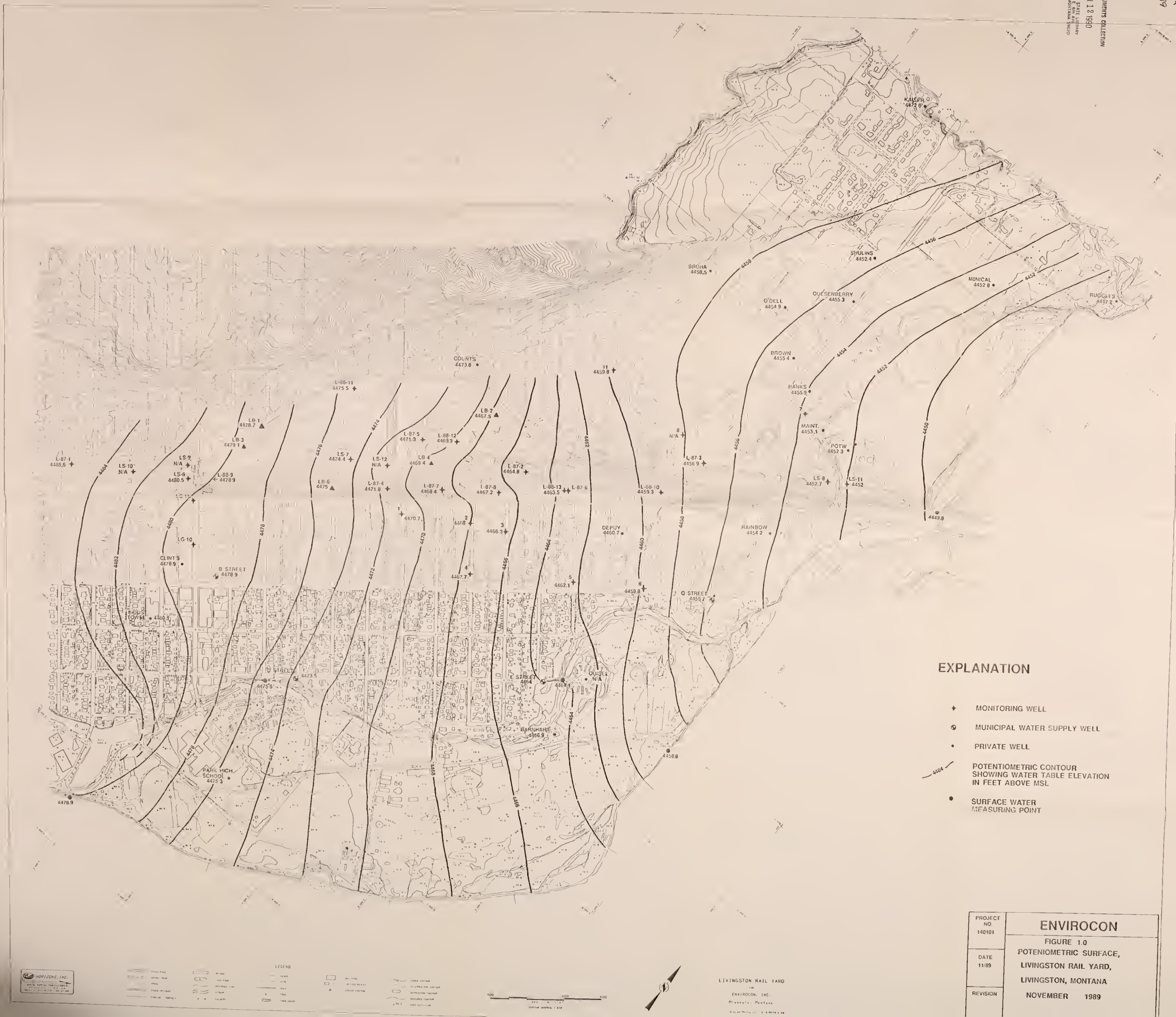


FIGURE 3.0

LIVINGSTON RAIL YARD
DIESEL PLUME
APPARENT THICKNESS IN FEET

CON

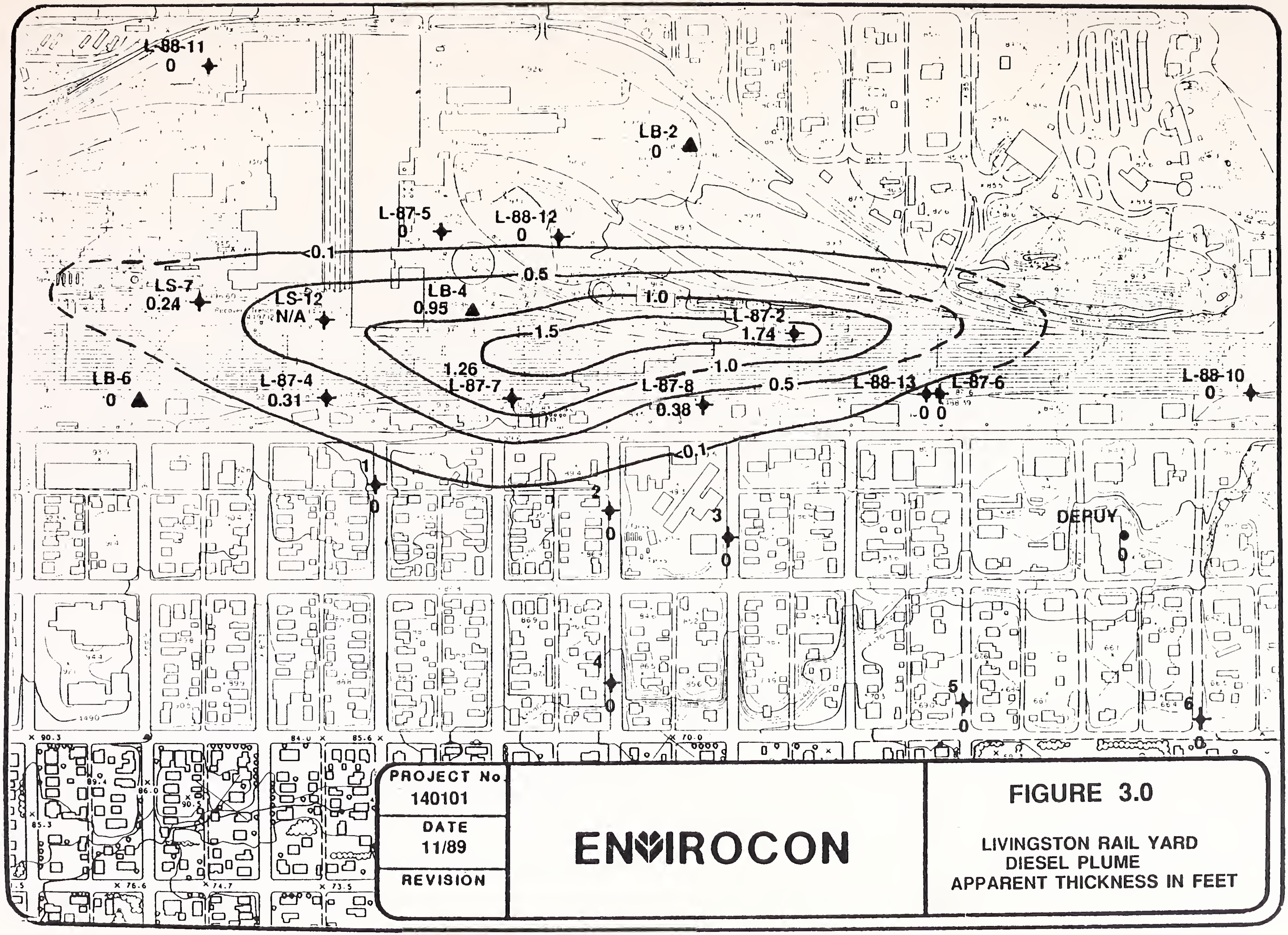
FIGURE 2.0



EXPLANATION

✦	MONITORING WELL
⊗	MUNICIPAL WATER SUPPLY WELL
•	PRIVATE WELL
4484	POTENTIOMETRIC CONTOUR SHOWING WATER TABLE ELEVATION IN FEET ABOVE MSL
●	SURFACE WATER MEASURING POINT

PROJECT NO. 140101	ENVIROCON
DATE 11/89	FIGURE 1.0 POTENIOMETRIC SURFACE, LIVINGSTON RAIL YARD, LIVINGSTON, MONTANA
REVISION	NOVEMBER 1989



PROJECT No.
140101

DATE
11/89

REVISION

ENVIROCON

FIGURE 3.0

LIVINGSTON RAIL YARD
DIESEL PLUME
APPARENT THICKNESS IN FEET